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ABSTRACT

Over the past four legislative sessions, the Texas State Legislature enacted laws that have accelerated the integration of technology into public education. The significant effort to build technology infrastructure in Texas is evident through the thousands of public school awards provided by the Telecommunications Infrastructure Fund (TIF) Board, the Technology Literacy Challenge Fund grants and the E-Rate discounts. With such an influx of funding into technology education, the following questions were posed to guide this inquiry: What technology resources have been put in place in schools as a result of these awards? What professional development activities are being provided to educators to use these technology resources? The telecommunications infrastructure in the public schools across Texas has changed significantly across the past six years with over 98% of classrooms in Texas public schools having Internet access, and technology professional development activities for Texas classroom teachers having increased. Yet much still needs to be accomplished, because just 21% of the districts indicate their teachers use online resources in their instruction. (Contains 11 references and 13 tables.) (Author)

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Abstract

Over the past four legislative sessions, the Texas State Legislature enacted laws that have accelerated the integration of technology into public education. Significant efforts to build technology infrastructure in Texas is evident through the thousands of public school awards provided by the Telecommunications Infrastructure Fund (TIF) Board, the Technology Literacy Challenge Fund grants and the E-Rate discounts. With such an influx of funding into technology education, the following questions were posed to guide this inquiry. What technology resources have been put in place in schools as a result of these awards? And second, what professional development activities are being provided to educators to use these technology resources? The telecommunications infrastructure in the public schools across Texas has changed significantly across the past six years with over 98% of classrooms in Texas public schools having Internet access, and technology professional development activities for Texas classroom teachers having increased. Yet much still needs to be accomplished, because just 21% of the districts indicate their teachers use on-line resources in their instruction.

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February 2, 2003

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In 1994, the *Goals 2000: Educate America Act* became law. This federal act contained a number of provisions designed to foster instructional applications of technology in classrooms across the nation (President's Committee of Advisors on Science and Technology, 1997). Soon thereafter, the Telecommunications Act of 1996 established public education's vehicle for accessing the national information infrastructure via the World Wide Web. Then in 2001, the No Child Left Behind Act (NCLB) emphasized technology literacy for students, teachers, administrators and parents (TEA, 2002). Collectively, these federal laws have highlighted technology infrastructure and staff development to use the technology for classroom applications to the degree these program characteristics have become important benchmarks to mark progress with classroom integration of technology.

Similarly over the past four legislative sessions, the Texas State Legislature has established laws that have accelerated the integration of technology into public education. To illustrate, the 74th Texas Legislature enacted three bills that have significantly affected technology integration, i.e., Senate Bill 1 - directed State Board of Education to develop a plan for schools to acquire and use technology; House Bill 2128 - established the Telecommunications Infrastructure Fund Board to develop an infrastructure among educational institutions, public libraries and medical facilities; House Bill 85 – directed the Texas Higher Education Coordinating Board to develop a master plan for distance learning (TEA, 2002). These and subsequent legislative acts have enabled significant efforts to build the technology infrastructure across Texas communities.

Since 1995, the Telecommunications Infrastructure Fund (TIF) Board has awarded approximately 1.2 billion dollars (TIF, 2002a) in telecommunication grants to four constituent groups (public schools, libraries, institutions of higher education and not-for-profit healthcare facilities with more than 7000 awards (TIF, 2002b). In addition, the Texas Education Agency has administered the federal flow-through competitive Technology In Education (TIE) grants program also called the Technology Literacy Challenge Fund grants that have provided $150.5 million dollars to school districts (between 191 to 452 ISDs per year) from 1997 through 2001. And during FY2002, TEA began administering the 'No Child Left Behind' program that has provided over $50 million dollars in TARGET grants [Technology Applications Readiness Grants for Empowering Texas students and teachers initiative] to Texas schools (TEA, 2002). With such an influx of funding into technology education, the following two questions were posed to guide this inquiry. *What technology resources have been put in place in schools*

as a result of these awards? And second, *what professional development activities are being provided to educators to use these technology resources?*

Few states invest adequately in either pre-service or in-service technology professional development for educators. As a result, most teachers have little direct experience in observing and learning about the wide range of computer-telecommunications applications for classrooms. A few years ago an Education Commission of the States document (ECS, 1998) stated that only 15 percent of the K-12 teachers in the nation received as much as 9 hours of training in technology. Further, this report noted that the average school district expenditures for technology devoted to teacher training was reported to be 6% while the recommended level was 30%. Since then expenditures have begun to rise; an annual survey by Market Data Retrieval noted that 17% of public school technology spending in FY00 went to teacher professional development (Web-based Education Commission, December 2000). In support of a greater investment in technology professional development, Becker (1999) reported a "staff development effect," for teachers using Internet-based instructional activities if they had access at home and school as well as having participated in professional development experiences on the use of the Internet for instruction. Finally, the Web-based Education Commission's report to the President and the Congress of the United States included the admonishment, "not enough is being done to assure that today's educators have the skills and knowledge needed for effective web-based teaching." The report goes on to state, that if this situation is not remedied, "we will have lost an opportunity to enhance the performance of a whole generation of new teachers, and the students they teach."

Context

In 1996, 1998, and again in 2000, the Texas Association of School Administrators (TASA) with technical support from the eEducation Group, formerly the South Central Regional Technology in Education Consortia-Texas (SCR*TEC-TX) staff at Texas A&M University (TAMU) conducted surveys of the technology infrastructure in Texas public schools. Between 69% and 82% of the public school districts in Texas participated in those survey efforts.

In 1998 and 2000, the Internet was used to collect responses from school districts by accessing an eEducation web site. This site provides an electronic file and associated software, the *Web Survey Builder* that enable data to be electronically collected with the added feature of allowing school personnel to partially complete the survey, exit the system, and then return at later times to complete and submit their responses. The collected data are then partitioned and analyzed with respect to different geographic and school size classifications enabling customized reports for each reader. Anecdotal evidence indicates this site has been frequently accessed and used in developing proposals for technology support by schools across the state. With recognition of the service TAMU has provided to school districts and state agencies with these Technology Infrastructure Surveys and support provided by the TIF Board, a decision was made to undertake another technology survey. It is hoped this effort conducted before the 78th

Texas Legislative session, will provide valued information to schools and legislators regarding technology integration in the public schools of Texas.

Method

Instrument Development

A draft of the survey instrument was reviewed at a meeting on August 28, 2002 held at TIF headquarters in Austin. This draft was based on preceding technology infrastructure survey instruments to enable comparisons with data from past effects. Participants at this meeting included Ellen Bell from TASA; Dirk Jameson, Delia Duffey and Wendy Latham from the TIF Board; and Jon Denton, Trina Davis, Arlen Strader and Brooke Durbin from TAMU. The instrument subsequently underwent revisions to incorporate suggestions offered at this meeting resulting in the final instrument that contains 51 items organized into the following seven sections [District Demographics (5 items), District Policies (6 items), District Technology Infrastructure (10 items), Technology Support and Sustainability (9 items), Technology Integration and Use (8 items), Professional Development (8 items), Outreach/Communication (5 items)]. The instrument and data collection procedures were submitted to and approved by the Texas A&M University Institutional Review Board for research involving human subjects on August 15, 2002. The items were then integrated with the *Web Survey Builder*, enabling the TIFB-TASA-TAMU supported effort entitled, **2002 Texas Pubic School Technology Infrastructure and Implementation Survey** to be conducted and instantaneously analyzed over the Internet.

Data Collection

Data collection for Wave 1 of the data collection protocol began Friday, September 20, 2002 when an e-mail communication was sent to 917* Texas school superintendents. [*One hundred twenty-three (123) school district e-mail addresses were not available on that date.] This communication included a request from Johnny Veselka, Executive Director of TASA to the superintendent citing the importance of completing the 2002 survey, as well as directions for accessing the online instrument. During the following three weeks, 232 school districts accessed the survey.

Wave 2 began with a second e-mail message from TASA being sent to 685 non-responding school districts between October 14 and October 18, 2002. An additional 100 messages were sent to school district superintendents whose e-mail addresses were located and confirmed through November 13, 2002. Given these efforts, 529 school districts had accessed the survey by November 18, 2002.

Wave 3 began on December 2, 2002 with telephone requests to non-responding school districts. Seven hundred five (705) school districts had accessed the survey on December 21, 2002 when the eEducation staff went on a holiday break. By the end of Wave 3, all

1040 Texas school districts had been contacted about participating in this technology survey effort.

The final effort (Wave 4) beginning January 13, 2003, entailed contacting school district personnel by phone who had partially completed the survey with a request to complete the online survey. Wave 4 activities concluded Thursday, January 23, 2003. At the conclusion of data collection, approximately 70% (n=729) of the Texas school districts had accessed the survey with 57% of the districts (n=591) having completed all 51 survey items, and an additional 13% of the districts had completed at least a portion of the survey. A review of districts responding to the survey from the twenty Educational Service Center regions was made. All regional service center regions were represented with the response ratio ranging from 55% (Region 1) to 80% (Region 3). Table 1 provides a regional breakdown of the number of participating districts.

Table 1. Percent of Districts by ESC Regions Participating in Survey

ESC Region	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Total # Districts (n=1040)	38	42	40	54	30	56	96	48	40	81	77	78	56	43	43	64	59	33	12	50
Districts Access. Survey (n=729)	21	26	32	38	21	41	65	29	31	55	57	53	41	30	33	47	41	26	7	35
Percent Access. (70%)	55	62	80	70	70	73	68	60	78	68	74	68	73	70	77	73	69	79	58	70

A review of the responding districts with enrollments of 50,000 or more students revealed that 10 of 13 districts responded to the survey. The cumulative student enrollment of the districts that responded to the survey represents approximately 72% of the total student public school enrollment in Texas. Table 2 provides a breakdown by district size of the number of participating districts.

Table 2. Number of Dist. by Dist. Size Participating in Survey				
District Size	Total Enrollment by District Size*	Number of Districts by District Size**	Number of Districts Accessing Survey	Approx. Enrollments of Accessing Districts
50,000 and Over	1,040,893	13	10	801,488
25,000 – 49,999	757,580	22	18	621,216
10,000 – 24,999	752,052	47	29	466,272
5,000 – 9,999	467,358	69	50	336,498
3,000 – 4,999	325,199	84	59	227,639
1,600 - 2,999	282,176	129	96	209,991
1,000 – 1,599	159,054	125	86	109,747
500 - 999	167,966	231	140	101,798
Under 500	107,341	320	228	76,480
Total	4,059,619	1,040**	716	2,951,129

* Enrollment values obtained from 2001 Snapshot (TEA, 2001)

** Number of districts with under 500 excluded 159 charter schools

Data Analysis & Findings

Once submitted, data were verified with respect to the district name and/or district-county identification number, and a TAMU staff member reviewed each item response. If item responses appeared unusual or questionable, the district was e-mailed to check and confirm responses to particular items. Once this validation process was completed, the district's data were concatenated with other district data and saved as Microsoft Excel files.

While the following tabular summaries provide information for a state-wide perspective, and a final report will be e-mailed to all Texas school districts, we encourage readers to refer to http://eEducation.tamu.edu/ for electronic renderings of the results of this survey effort that can be specialized for particular information needs. Report summaries can be generated by district size (enrollment) or location (Educational Service Center Region).

Summary of Survey Items

The following tables present cumulative responses for each survey item on the ' 00 and ' 02 Surveys. A few items requested textual responses that are not summarized in the tables.

Table 3. Texas Public School Technology Infrastructure Survey Findings – District Policies		
Item	2000 Survey	2002 Survey
District Policies	Percent	Percent
1. Has your district benefited from HB2128 (TIF Board funding)? [% responding Yes]	87	89
2. Has your district applied for an E-Rate (federal) rebate? [% responding Yes]	93	93
3a. What has been reimbursed by E-Rate rebate? [% responding – Internet Access]	72	77
3b. What has been reimbursed by E-Rate rebate? [% responding – Internal Wiring]	36	29
3c. What has been reimbursed by E-Rate rebate? [% responding – Telecommunication Services]	79	82
3d. District has NOT been awarded an E-Rate discount in any of these areas	13	10
4. Does your district use Internet filtering software? [% responding Yes]	89	97
5a. Does your district have an "acceptable use policy for school technology resources?" - for students [% responding Yes]	92	93
5b. Does your district have an "acceptable use policy for school technology resources" - for staff [% responding Yes]	88	90
5c. Does your district have an "acceptable Internet use policy?" - for students [% responding Yes]	97	95
5d. Does your district have an "acceptable Internet use policy?" - for staff [% responding Yes]	89	92
5e. Our district does not have a technology "Acceptable Use Policy"	1	1
6a. Desired technology assistance [% responding staff development on technology integration in class]	81	81

6b. Desired technology assistance – [% responding developing grant applications for technology support]	66	64
6c. Desired technology assistance – [% responding establishing a technology consortium]	42	39
6d. Desired technology assistance – [% responding developing a technology infrastructure plan and cost estimate]	31	32
6e. Desired technology assistance – [% responding developing a district technology use plan]	37	39
6f. Desired technology assistance – [% responding conducting a district/school technology audit]	39	40

Survey items on district technology policies range from district benefits realized from TIF Board funding and E-Rate rebates, Internet use policies, and types of technical assistance that would be beneficial to districts. Responses on the ' 00 and ' 02 surveys across these items are marked by similarities rather than large differences. For example, 87% and 89% of school district technology coordinators/administrators indicated they have benefited from TIF Board funding in 2000 and 2002, respectively, and 89% of the 2000 respondents and 97% of the 2002 respondents indicated that their districts use Internet filtering software. The response spread for filtering software is among the greatest differences noted across these item summaries. Collectively, these responses indicate a high level of participation in programs that have provided financial resources to schools, high levels of acceptable use policies for the Internet, and a continuing need for professional development on technology integration in the classroom.

Table 4. Texas Public School Technology Infrastructure Survey Findings – District Technology Infrastructure		
Item	2000 Survey	2002 Survey
District Technology Infrastructure		
7a. How many Internet-accessible computers are located in your elementary classrooms? [Average #]	2.2	2.2
7a. How many Internet-accessible computers are located in your middle school classrooms? [Average #]	2.2	2.1
7a. How many Internet-accessible computers are located in your high school classrooms? [Average #]	2.3	2.6
items 8 & 9 are related to items 7 & 10		
10a. What percentage of elementary classrooms have internet access?	94%	98%
10b. What percentage of middle school classrooms have internet access?	97%	98%
10c. What percentage of high school classrooms have internet access?	96%	99%
11. What is the bandwidth of your districts main Internet connection? [% of reporting districts with T1 or greater bandwidth]	90%	93%
12. How many of your district's campuses have 2-way videoconferencing capabilities? [Average #]	1	1
13. How many of your campuses have video distribution from a central source? [Average #] 2000 survey only	2	-
14/13. How often do you replace old technology? 4-5 years [% of reporting districts]	48%	51%
15/14. What percentage of your teachers have home access to the Internet? [half to all teachers]	46%	63%
16/15. What percentage of your students have home access to the Internet? [half to all students]	16%	26%
17/16. What is your greatest need in technology infrastructure? [highest % "more classroom computers"]	46%	51%

Item summaries in Table 4 convey a leveling rather than a large increase of technology infrastructure. To illustrate, across the surveys the number of Internet accessible computers per classroom was unchanged at 2.2 in elementary schools, diminished from

2.2 to 2.1 in middle schools, and increased from 2.3 to 2.6 in high schools. Yet increasing the number of classroom computers has been cited as the greatest infrastructure need in both 2000 and 2002. Another hint of leveling is the slight increase in the replacement cycle of 4 to 5 years for technology hardware across the surveys.

From the perspective of growth or increased technology resources, Internet access increased moderately from 94% to 98% in elementary schools, from 97% to 98% in middle schools, and from 96% to 99% in high schools. Connectivity in classrooms was reported to be above 95% across all school levels in the ' 00 survey and is approaching 100% across all school levels in the ' 02 survey. These values correspond with a recent evaluation report finding from the Texas Center for Educational Research (TCER) that 99% of school principals report their classrooms have at least one Internet connection, and classrooms now average more than four drops per room (TEA, 2002). Finally, Table 4 reveals a sizeable increase in the estimated number of teachers and students with Internet access from their homes across the two surveys.

Table 5. Texas Public School Technology Infrastructure Survey Findings – Technology Support and Sustainability		
Item	2000 Survey	2002 Survey
18/17. Last year, what did you spend on technology? [Average $ reported]	$596,490	$451,403
19/18. Last year, what did you spend for professional development on technology? [Average $ reported]	$98,877	$64,372
20/19. Number of on-site technical support personnel [% of districts reporting support provided from central office]	60%	62%
21/20. Number of on-site instructional technology support personnel [% of districts reporting support provided from central office]	47%	52%
22/21. Average response time for technical support [cumulative % reported " within 2 hrs and same day"]	36%	36%
23/22. Average response time for instructional support [cumulative % reported "within 2 hrs and same day"]	47%	39%
24/23. What is your greatest need in technology support and sustainability? [highest % reported – more technical support personnel]	50%	39%
25a/24a. Does your district make laptops available for checkout to faculty? [% of districts reporting Yes]	38%	51%
25b/24b. Does your district make laptops available for checkout to students? [% of districts reporting Yes]	8%	13%
25a (2002 survey), Indicate the types of technology applications available [wireless laptop carts]	*	51%
25b (2002 survey), Indicate the types of technology applications available [presentation stations including projection devices]	*	84%
25c (2002 survey), Indicate the types of technology applications available [electronic writing tools, e.g., AlphaSmart]	*	30%
25d (2002 survey), Indicate the types of technology applications available [document cameras]	*	63%
25e (2002 survey), Indicate the types of technology applications available – [personal digital assistants (PDA)/handheld computers]	*	27%
25f (2002 survey), Indicate the types of technology applications available [computerized sensors/probeware]	*	25%
25g (2002 survey), Indicate the types of technology applications available [eBook readers]	*	8%
25h (2002 survey), Indicate the types of technology applications available [telephones in classroom]	*	31%

* Item not included on that survey.

A tenable conclusion drawn from the initial two items in Table 5 is that a substantial reduction of funding for technology has occurred over the past two years with a corresponding drop in support for technology professional development. Yet a positive change has occurred with the increased availability of laptop computers to check-out for home use by teachers and students. Also during this period, technical support available to teachers has increased slightly. Augmenting the technical support finding, the TCER evaluation includes the finding that for larger districts, teachers report technology-related support from a district instructional specialist and on-site support from campus technology coordinators, media specialists and expert teachers, while for districts with small enrollments, teachers receive technical assistance from a district technology coordinator (TEA, 2002).

Responses to the new item on the ' 02 survey about the types of hardware being provided for classroom use, indicate the most cited hardware being provided are computer projection systems, digital cameras, and wireless laptop carts. Teachers in the TCER evaluation reported that classrooms do have a substantial percentage of printers and projection devices, but other technology tools usually are available at the building rather than the classroom (TEA, 2002). The high level of projection equipment available (84%) given the responses to our survey suggests this technology tool may be employed by teachers and their students for classroom presentations. Also, the evolving availability of wireless laptops (51%) and personal digital assistants (27%) may indicate a shift from teacher-centered to learner-centered instructional activities in Texas classrooms.

Table 6. Texas Public School Technology Infrastructure Survey Findings – Technology Integration and Use		
Item	2000 Survey	2002 Survey
26. What percent of your teachers use technology productivity software? [% of districts reporting .75 to all teachers]	55%	58%
27. (2000 survey) What % of your teachers use instructional software in support of the TEKS? [% of districts reporting .75 to all teachers]	19%	*
27a. (2002 survey) How is technology being integrated across the school district? – elementary campuses [computer literacy class]	*	35%
27b. (2002 survey) How is technology being integrated across the school district? – elementary campuses [integrated into core content areas]	*	76%
27c. (2002 survey) How is technology being integrated across the school district? – middle school campuses [computer literacy class]	*	63%
27d. (2002 survey) How is technology being integrated across the school district? – middle school campuses [integrated into core content areas]	*	74%
27e. (2002 survey) How is technology being integrated across the school district? – high school campuses [integrated into core content areas]	*	70%
27f. (2002 survey) How is technology being integrated across the school district? – high school campuses [Computer Science I]	*	58%
27g. (2002 survey) How is technology being integrated across the school district? – high school campuses [Computer Science II]	*	42%
27h. (2002 survey) How is technology being integrated across the school district? – high school campuses [Desktop Publishing courses]	*	63%
27i. (2002 survey) How is technology being integrated across the school district? – high school campuses [Digital Graphics/Animation courses]	*	32%
27j. (2002 survey) How is technology being integrated across the school district? – high school campuses [Multimedia courses]	*	46%
27k. (2002 survey) How is technology being integrated across the school district? – high school campuses [Video Technology courses]]	*	24%
27l. (2002 survey) How is technology being integrated across the school	*	62%

district? – high school campuses [Web-Mastering courses]		
27m. (2002 survey) How is technology being integrated across the school district? – high school campuses [Career and Technology courses]	*	72%
28a. What % of your teachers use the Internet for e-mail/online forums? [% of districts reporting .75 to all teachers]	58%	72%
28b. What % of your teachers use the Internet for accessing Web-based curricula? [% of districts reporting .75 to all teachers]	10%	20%
28c. What % of your teachers use the Internet for collaborative learning projects? [% of districts reporting .75 to all teachers]	2%	1%
28d. What % of your teachers use the Internet for research? [% of districts reporting .75 to all teachers]	22%	25%
29. What percent of your teachers have integrated technology into their teaching? [% of districts reporting .75 to all teachers]	17%	18%
30a. What % of your teachers are just beginning to learn technology applications? [Average %]	12%	9%
30b. What % of your teachers know the basics and use computer for e-mail? [Average %]	37%	33%
30c. What % of your teachers are beginning to use Internet for instruction? [Average %]	24%	26%
30d. What % of your teachers are using on-line resources and using Internet tools in student assignments? [Average %]	18%	21%
30e. What % of your teachers use technology to plan and collaborate in creating a student-centered curriculum? [Average %]	8%	9%
31a. Indicate the average number of hours per week elementary students use computers for learning. [highest % - 5 to 9 hrs]	18%	23%
31b. Indicate the average number of hours per week middle school. students use computers for learning. [5 to 9 hrs]	30%	33%
31c. Indicate the average number of hours per week high school students use computers for learning. [highest % - 5 to 9 hrs]	38%	37%
32a. What % of your students use computers for productivity applications? [% of districts reporting .75 to all students]	14%	14%
32b. What % of your students use computers for drill and practice? [% of districts reporting .75 to all students]	13%	11%
32c. What % of your students use computers for on-line research on topics? [% of districts reporting .75 to all students]	18%	12%
32d. What % of your students use computers for accessing Web-based curricula? [% of districts reporting .75 to all students]	2%	3%

* Item not included on that survey.

Participants of the '02 survey were asked to identify how technology is being integrated across elementary, middle school and high school classrooms. Technology integration in core content subjects across all grade levels was cited as the most common type of technology integration occurring in their schools. This observation is extended by the TCER evaluation finding that technology applications occur most often in English classes, followed by social studies, science and finally mathematics (TEA, 2002). Frequently noted curricular experiences being offered are career and technology courses, desktop publishing courses, and web mastering courses. Items that were posed on both surveys in Table 6 yielded very similar responses across most of the items. For example, for the item 32a, "What % of your students use computers for productivity applications?" the summarized responses were 14% for both the '00 and '02 surveys, and for item 29, "What percent of your teachers have fully integrated technology into their teaching?" the summarized responses were 17% on the '00 and 18% on the '02 surveys. The TCER evaluation provides teacher perspectives that support these modest levels of technology integration. Barriers that teachers cite to using technology in their classes include lack of

time to learn and practice using technology, and insufficient availability of classroom computers (TEA, 2002).

Different responses occurred for item 28a, "What % of your teachers use the Internet for e-mail/online forums?" where the summarized responses were 58% on the '00 survey and 72% on the '02 survey. For item 28b "What % of your teachers use the Internet for accessing online curricula?" the summarized responses were 10% on the '00 survey and 20% on the '02 survey. Both of these item summaries suggest a gradual shift to communication opportunities and web-based resources by teachers. These item summaries are supported by a TCER evaluation finding that teachers most commonly report technology uses such as creating instructional materials, communicating with colleagues, and using the Internet to gather information for lesson planning (TEA, 2002).

The final cluster of items in Table 6 provide percentages of students using various Internet applications. Similar to the summaries of the teacher technology applications across this time frame, student technology applications have remained nearly constant across the past two years. The TCER evaluation includes interesting perspectives from students about technology, such as, assessing their teachers' computer abilities as limited compared with their own computer skills, and citing strong impacts of technology use on the quality of their learning experiences and their academic performance (TEA, 2002).

Table 7. Texas Public School Technology Infrastructure Survey Findings – Professional Development		
Item	2000 Survey	2002 Survey
33. What is your district's greatest need in the area of technology integration and use [highest % reported – staff development in technology applications]	56%	53%
34. What % of your teachers use professional development ideas to design lessons [% of districts reporting .75 to all teachers]	10%	12%
35a. Who are the technology professional development providers in your district? [highest % reported – ESC personnel]	75%	77%
35b. Who are the technology professional development providers in your district? [next highest % reported – full time teacher]	46%	44%
36. (2000 survey) How is your district's technology professional development delivered? [highest % reported – face to face]	92%	*
36a. (2002 survey) What are the most effective training methods for helping teachers to integrate technology [face-to-face workshops – ranked first]	*	48%
36b. (2002 survey) What are the most effective training methods for helping teachers to integrate technology [on-line instruction and conference attendance – tied ranked third]	*	38%
37. What type of technology professional development is needed most? [highest % reported – curriculum integration]	55%	53%
38. (2002 survey) What professional development activities are most needed to support technology integration? [examples and modeling of best practice]	*	57%
38/39. What is your greatest need for administrators' technology professional development? [highest % reported – strategic planning, and evaluation and identification of best practices]	34%	35%
39/40a. Estimate the hours of campus-based technology professional development for basic technology skills.[% reported for 7-12 hrs]	19%	49%
39/40b. Estimate the hours of campus-based technology professional development using technology for communications (e-mail, LISTSERVE@) offered per year. [% reported for 7-12 hrs]	14%	60%
39/40c. Estimate the hours of campus-based technology professional	21%	49%

development to use technology to plan instruction, basic Internet use offered per year. [% reported for 7-12 hrs]		
39/40d. Estimate the hours of campus-based technology professional development using on-line resources in the curriculum offered per year. [% reported for 7-12 hrs]	18%	43%
39/40e. Estimate the hours of campus-based technology professional development on collaborating with others to create student centered curriculum offered per year. [% reported for 7-12 hrs]	16%	46%
40/41. Average hours of professional development completed for each teacher each year [highest % reported for 1-6 hrs]	35%	36%

* Item not included on that survey.

Table 7 items address technology professional development of educators. Item summaries here continue to reflect very similar response patterns across the surveys on the initial cluster of items presented in this table. Staff development in technology applications is the most cited need in both the '00 and '02 surveys. Data summaries from both surveys indicate the professional development providers are primarily Educational Service Center personnel and teacher colleagues who provide face-to-face experiences for 1 to 6 hours perschool year. These characteristics for technology professional development experiences have remained stable across the past two surveys.

An evolving process for professional development is the online experience. Online professional development experiences were cited as a delivery option by 38% of the respondents in the ' 02 survey.

Over the past two years, marked changes have occurred for the hours of professional development provided for basic technology skills (19% to 49%), communications (14% to 60%), instructional planning with technology (21% to 49%), using online resources (18% to 43%).and creating student-centered curricula (16% to 46%). These changes suggest that technology professional development is being tailored to the needs of individual faculty given the breadth of skills being offered (i.e., from basic technology skills to developing online resources). Support for this hunch about technology professional development being tailored for teachers comes from the TCER evaluation finding that technology training experiences differ by school size, with principals from larger schools reporting on needed professional development on content-specific lesson plans, integration in the one-computer classroom, and in-depth theories supporting integration. In contrast, principals from smaller schools and smaller districts usually cite the need for technology training on basic applications, applications for enhancing student basic skills, and advanced telecommunications (TEA, 2002).

Table 8. Texas Public School Technology Infrastructure Survey Findings – Outreach/Community		
Item	2000 Survey	2002 Survey
41a/42a. Does your district use the web to communicate general information to the public? [% responding Yes to providing district calendar]	75%	79%
41b/42b. Does your district use the web to communicate general information to the public? [% responding Yes to providing achievement data]	43%	46%
41c/42c. Does your district use the web to communicate general information to the public? [% responding Yes to providing faculty directory]	50%	63%

41d/42d. Does your district use the web to communicate general information to the public? [% responding Yes to providing home work online]	15%	20%
42/43. Percent of teachers with instructional Web pages to communicate with parents/students [% of districts reporting .76 to all teachers]	2%	2%
43. (2000 survey) Do you provide computer access to community members outside of school day? [% responding Yes]	48%	*
44. (2000 survey)Average number of individuals using district computer resources. [highest % reported this service 1-9 individuals]	23%	*
44a. (2002 survey) Average number of individuals using district provided technology services on weekly basis –Computer lab with Internet connectivity [highest % reported this service 1-9 individuals]	*	28%
44b. (2002 survey) Average number of individuals using district provided technology services on weekly basis –Technology application workshops [highest % reported this service 1-9 individuals]	*	24%
45. What organizations do you collaborate with in your community to share tech resources [highest % reported - public library]	57%	33%

* Item not included on that survey.

Outreach and community technology services offered by school districts were addressed in Table 8. Cumulative responses for this cluster of items across the two surveys reflect small increases for Internet applications for community outreach across the two surveys. Over the past two years, small increases have occurred for online communication resources being provided to parents and patrons of the school district. To illustrate, more district web sites now contain school calendars (75% to 79%); district achievement data (43% to 46%); home work assignments (15% to 20%); and a faculty directory (50% to 63%) than was the case in 2000. In contrast, faculty web pages generally have not been included on district web sites as a means of communicating the quality and experience of the district's professional staff.

Highlights from Item Summaries

- High percentage of districts reporting TIF Board funding awards (89%)
- Consistently high level of district participation in E-Rate telecommunications rebate program (93%)
- High percentage of districts using Internet filtering software (97%)
- High percentage of districts with acceptable use policies for technology resources by students (93%)
- High percentage of districts with acceptable Internet use policies for students (95%)
- Ratio of Internet-linked computers : classroom (2.1 to 2.6)
- High percentage of Texas public school classrooms with Internet access (98 - 99%)
- Approximately half of the districts provide laptops for check-out to their teachers
- Average of one (1) two-way videoconferencing system per district
- Most cited technology replacement cycle by districts is 4 to 5 years
- Greatest infrastructure need cited by districts: **more classroom computers**
- Sixty-two percent (62%) of the participating districts report providing technical support personnel for hardware and networking problems.
- Thirty-six percent (36%) of the participating districts report the average response time for providing technical assistance is the same day the request was submitted

- Web sites are used by 79% of the districts to communicate with parents and community patrons

Technology Trends

A number of comparisons are offered from information collected across the four state-wide surveys conducted by the investigators beginning with the 1996 survey. Financial support, professional development, technology infrastructure, and use of technology are examined to determine the trends across this six-year period.

Technology Infrastructure Support : Similar questions were posed across surveys about expenditures targeted for technology. The following question from the '00 survey captures the essence of the items posed. *"During the ... school year, what amount (in dollars) of your total annual expenditures was dedicated to technical and instructional technology support? (Include salaries, hardware, software, development activities, etc.)"* Although the items were expressed similarly across the surveys, the response option changed for the '00 survey, preventing a direct comparison across this period for average expenditures, except for the '00 and '02 surveys.

Table 9. Financial Support for Technology Infrastructure Reported by School Districts				
Amount	**1996***	**1998***	**2000***	**2002***
Less than $250,000	628	497	411	430
Between $250K and $500K	59	118	82	90
Between $501K and $1M	8	43	44	44
Between $1M and $10M	59	76	60	39
Above $10M		11	6	4
Average expenditure			$ 596,490	$451,403
* number of School Districts reporting	754	745	603	607

The source of funds was not asked in these questions, but it is reasonable that state and federal funds have augmented local funds and influenced technology expenditures by school districts. Examining the expenditures across the funding support categories and years indicate districts increased technology expenditures substantially between 1996 and 1998, given the high frequency of districts in the high dollar expenditure categories. Yet from 1998 to 2000, technology expenditures by the districts leveled off, and began to decrease between 2000 and 2002 with increasing frequencies of districts occurring in the lower dollar expenditure categories.

An average technology expenditure of nearly $600,000 was reported in '00, while the average in '02 was approximately $450,000 a **decrease** of $150,000 per district. A

corresponding reduction of over $34,000 per district for technology professional development occurred during this period (see table 5).

Professional Development on Technology: Although the four surveys posed a number of questions about staff development related to technology, items were sufficiently different permitting just two direct comparisons. The topic of professional development and the number of sessions provided by the districts each year have offered bases for comparison across time. Table 10 provides a summary of district responses to these common variables. Across the six years covered by these surveys, the emphasis placed on technology professional staff development in schools across Texas has increased. The two ends of the continuum (i.e., more than 10 sessions and no sessions offered) reflect the shift toward greater emphasis on technology training to professional staff across the schools.

The topic noted by approximately 80% of the respondents across the 6 year time frame is a need for professional development on **technology integration** in classrooms, and the re-occurring request for assistance with **grant procurement** by more than 60% of the respondents across the surveys. Considered together, these trends suggest school districts anticipate that external funding will provide resources for technology for technology professional development in the future.

Table 10. Professional Development on Technology Reported by School Districts				
Number of Sessions	**1996**	**1998**	**2000**	**2002**
	%	%	%	%
More than 10	9	30	29	25
7 to 10	3	18	27	27
3 to 6 *	20	31	17	18
1 to 2 *	49	17	17	18
No sessions	20	4	4	1
Total Responses	847	781	638	619
Assistance Needs of School Districts				
Grant procurement	68	76	66	64
Conducting technology audits	44	46	40	40
Forming a technology consortium	48	44	42	39
Developing a technology use plan	56	46	37	39
Staff Development on technology integration	78	89	81	81
Total Responses	847	727	638	626

* 2000 and 2002 surveys combined the number of sessions into single category (1 to 6), reported value represents .5 of recorded value.

Current Technology Infrastructure: Internet classroom access has been examined across the surveys and is summarized in Table 11. Access increased dramatically at the campus level, illustrated by high percentages of classrooms with "No Internet Access" in ' 96, while the percentage of campus classrooms having "75% or More Internet Access" in '

00 and ' 02 indicate a very high level of access. Clearly, remarkable progress has occurred in bringing connectivity to classrooms across the past six years.

Table 11. Number of Classrooms with Internet Access	Year	Reporting Districts	No Access	75% or More Access
Elementary School Classrooms			Percent	Percent
	1996	841	85	12
	1998	580		49
	2000	635		94
	2002	630		98
Middle School				
	1996	841	85	10
	1998	517		53
	2000	635		97
	2002	628		98
High School				
	1996	841	74	19
	1998	567		65
	2000	635		96
	2002	629		99

While classrooms across the state have connectivity, availability of Internet-linked computers for individual students remains an unmet goal. In addition to Internet access all surveys have addressed the number of computers per student. Beginning with the ' 00 survey, districts were asked to indicate the number of Internet-accessible computers located in their classrooms. The responses across elementary, middle and secondary schools range from 2.1 to 2.6 Internet-linked computers per classroom across the ' 00 and ' 02 surveys (see Table 4). For the sake of comparison, recommendations in the state's long range plan for technology is 4.5 to 5 Internet-linked computers per classroom for 2003-2004 then advancing to a computer per student by 2010 (TEA, 2002).

Use of Technology: Comparable items across the surveys included classroom use of Internet by students and the type of Internet applications. Tables 12 and 13 present these data although the nature of the presented information varies due to the nature of the response opportunities provided on the surveys.

Table 12. Percent of Students Using Internet in Class	Year	Reporting Districts	Percent No Access	Percent (1- 49)	Percent (50- 75)	Percent (76-100)
Internet-based Instruction						
	1996	840	74	22	1	0
*	1998	776		69	18	14
**	2000	619	1	48	27	18
**	2002	619	0	43	31	19

* ' 98 survey Instrument did not contain the category "no access"

** Percent values do not total 100% due to non-responses to this item.

Increased use of the Internet for instruction is evident across time. A shift from 74% of the students with no access to the Internet in class changed substantially in just two years

with 14% of the districts reporting that 76-100 percent of their students were using the Internet in class in the ' 98 survey. Interestingly, the percent of districts reporting that 76-100 percent of their students were using the Internet in class has not changed substantially since the '98 survey. While Internet access is available in classrooms, the transition to Internet-based instruction appears to be occurring at a much more deliberate rate, perhaps due to the limited number of Internet-accessible computers in the classroom.

Table 13: Percentage of Student Internet Applications Across Years by 50% to all Students in District*				
	1996	**1998**	**2000**	**2002**
Reporting Districts	841	727	619	619
	Percent	Percent	Percent	Percent
E-mail/ on-line forums	1	10	-	-
Exploring (web-browsing)	1	29	-	-
Accessing web-based curricula	0	16	5	8
Research for class assignments	2	26	45	49
Collaborative learning multiple sites	-	6	3	4
Creating Multi-Media Projects	-	8	11	13
Problem solving	-	-	9	11
Simulations	-	-	2	3

* Empty cells due to item differences across the surveys

Comparing the kinds of Internet applications by students across the past six years is difficult due to the types of response opportunities provided on the surveys. A number of different applications were provided across the surveys and the response options changed on the '00 and '02 surveys. In general, on-line research for class assignments has evolved as an application and is now used widely by students, while collaborative learning projects, problem solving exercises, and accessing web-based curricula are being integrated by students at a slower rate. One reason for the different rates of adoption may be that the technology skills required for conducting simulations, problem solving and creating multi-media products are more complex than seeking and downloading resources from the web.

Discussion and Conclusions

The telecommunications infrastructure in the public schools across Texas has changed significantly across the past six years. Financial support for technology to schools has been substantial, resulting in dramatic changes in classroom connectivity and classroom technology equipment. The level of connectivity recorded in 1996 was modest with districts reporting **no** classroom access to the Internet (74% for high school classrooms to 85% for elementary and middle school classrooms) , while in 2002, over 98% of classrooms in Texas public schools participating in this survey reported having Internet access. These connectivity values, compare very favorably with national values, that report classroom connectivity soared from 14% in 1996 to 63% in 1999 (Web-based Education Commission, December 2000). These dramatic changes in connectivity in Texas public schools have been impacted substantially by the 7000 awards provided by the TIF Board (TIF Website, 2002b); the 1,963 awards of the Technology Literacy Challenge Fund (TEA, 2000); and the high level of participation in the E-Rate program (TEA, 2000).

In terms of Internet-linked workstations for students, the ' 02 survey results from participating districts indicate today's classroom holds 2+ networked computers nearly unchanged from the ' 00 survey results. This ratio corresponds to the student to computer ratio of 8.9:1 value reported for 1999 in the Texas Education Agency's *Progress Report on the Long-range Plan for Technology, 1996-2010* (December, 2000), and the national average of 9 to 1 (Web-based Education Commission, December 2000). While these values are consistent with one another, a substantial gap exists between the current ratio and the recommended student to computer ratio of 4:1 in the *2002 Update to the Long Range Plan for Technology, 1996-2010* (TEA, 2002).

Technology professional development activities for Texas classroom teachers have received much support across time. This is encouraging information, but much still needs to be accomplished, because only 20% of the participating districts indicate their teachers and students use on-line resources in their instruction. For comparison purposes at the national level, *The Power of the Internet for Learning Moving from Promise to Practice* (Web-based Education Commission, December 2000) noted that a survey found that most teachers have some facility using computers, but do not know how to apply these computer skills in classroom instruction. Perhaps this is what district technology coordinators were thinking in the ' 02 survey, when the most needed technology professional development program cited was for curriculum integration with technology.

Given the responses to the survey and the trend analyses, slightly modified recommendations from a recent national report (Web-based Education Commission, December 2000) appear to be appropriate for concluding this discussion:

- Sustain technology funding for Texas public schools to prevent the "Digital Divide" from occurring in our schools;
- Continue providing reliable safeguards to protect on-line learners and ensure their privacy;
- Increase "on-request" technical and instructional support to teachers for technology problems;
- Continue high quality, on-demand professional development support for teachers and administrators;
- Provide on-line educational content that is affordable and meets the highest standards of educational excellence; and
- Enable universal broadband access at home and school to support learner-centered educational opportunities.

This report provides evidence that Texas schools are attaining each of these recommendations. For the recommendations of broadband access at school, and reliable safeguards to protect on-line learners, Texas districts are approaching the criterion of 100 percent for providing the recommended broadband service and investing in technology. This is a remarkable accomplishment that has enabled Texas public schools to have sufficient web access to reduce the well publicized "Digital Divide" occurring in schools and homes across the nation. Providing high quality professional development, and providing rapid technology technical assistance are services that schools are "in-

progress" of attaining, but continued effort and additional resources are needed to attain these recommendations. School districts in Texas appear to be at the beginning of their journeys for providing broadband access to the students at home, and for developing and using quality on-line educational content. For these recommendations to be completely met, continuing resources are essential from state and federal sources to schools. The remarkable changes in the technology infrastructure supporting Texas public schools can be directly linked to school leaders attuned to the E-Rate program and the grants and policies of the Telecommunications Infrastructure Fund Board and federal grant programs. These resources have been invaluable in integrating technology into classroom activities and must be continued, if our students are to benefit from a digital advantage that our schools now can provide.

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